Table C.1.d. Falls prevention

Information sources and search

The present report updates the searches performed in the 2019 Cochrane Review*(17)*, with this review extending studies published up to 7 November 2019. This review extended the searches performed up to February 2012 in the 2012 Cochrane Review*(23)*. We searched: the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (2 May 2018 to 7 November 2019); the Cochrane Central Register of Controlled Trials. (CENTRAL) (Cochrane Register of Studies Online) (2018 Issue 1 to 7 November 2019); MEDLINE (including Epub Ahead of Print, In-Process & Other Non-Indexed Citations and MEDLINE Daily) (start 2018 to 7 November 2019); Embase (start 2018 to 7 November 2019); the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (May 2018 to 7 November 2019); and the Physiotherapy Evidence Database (PEDro) (2018 to 2019), using tailored search strategies. We did not apply any language restrictions. In MEDLINE, we combined subject-specific search terms with the sensitivity- and precision-maximising version of the Cochrane Highly Sensitive Search Strategy for identifying randomised trials.*(24)* The search strategies for CENTRAL, MEDLINE, Embase, CINAHL and PEDro are shown in Appendix 1). We also searched the World Health Organisation International Clinical Trials Registry Platform (WHO ICTRP) and ClinicalTrials.gov for ongoing and recently completed trials (November 2019) (see Appendix 1). We checked reference lists of other systematic reviews as well as contacting researchers in the field to assist in the identification of ongoing and recently completed trials.

Study selection

Independent reviewers (NF, WK) screened the title, abstract and descriptors of identified studies for possible inclusion. From the full text, these review authors independently assessed potentially eligible trials for inclusion and resolved any disagreement through discussion with a third author. We contacted authors for additional information as necessary.

Data collection process

Pairs of reviewers (CS, NF, WK) independently extracted data using a pretested data extraction form (based on the one used in the Cochrane Review*(25)*). Disagreement was resolved by consensus or third party adjudication. Review authors were not blinded to authors and sources. Review authors did not assess their own trials.

Data items

Full details of data extracted (excluding the nine new trials included in this update) are shown in Sherrington 2019. The present publication focuses on the primary outcome, the rate of falls. We grouped similar exercise interventions using the fall prevention classification system (taxonomy) developed by the Prevention of Falls Network Europe (ProFaNE)*(26)*. For simplicity the ProFaNE category gait, balance, co-ordination or functional task training was referred to as balance and functional exercises.

Risk of bias and certainty of evidence

One review author (NF) assessed risk of bias using Cochrane's Risk of bias tool as described in the Cochrane Handbook*(27)*. We constructed and visually inspected funnel plots. We used The Grading of Recommendations Assessment, Development and Evaluation **(**GRADE) approach to assess the quality of evidence*(28)*; we assessed the certainty of the evidence as 'high', 'moderate', 'low' or 'very low' depending on the presence and extent of five factors: risk of bias; inconsistency of effect; indirectness; imprecision; and publication bias. We prepared 'Summary of finding' tables. We used standardised qualitative statements to describe the different combinations of effect size and the certainty of evidence*(29)*.

Rate of falls outcome (falls per person-years) for types of exercise

Type of exercise	Follow-up range	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Certainty of the evidence (GRADE)	Comments
		Assumed risk	Corresponding risk				
Exercise[a] (all types) versus control[b] (e.g. usual activities)	3 to 30 months	Control	Exercise (all types)	Rate ratio 0.77 (0.71 to 0.83) [d]	14.306 (64 RCTs)	High[e]	Overall, there is a reduction of 23%(95%CI 17% to 29%) in the number of falls Guide to the data: If 1000 people were followed over 1 year, the number of falls in the overall population would be 655 (95% CI 604 to 706) compared with 850 in the group receiving usual care or attention control. In the unselected population, the corresponding data are 466 (95%CI 430 to 503) compared with 605 in the group receiving usual care or attention control. In the selected higher-risk population, the corresponding data are 993 (95%CI 915 to 1071) compared with 1290 in the control group
		All studies population					
		850 per 1000[c]	655 per 1000 (604 to 706)				
		Not selected for high risk population					
		605 per 1000 [c]	466 per 1000 (430 to 503)				
		Selected for high risk population					
		1290 per 1000 [c]	993 per 1000 (915 to 1071)				
Balance, and functional exercises[f] versus control[b] (e.g. usual activities)	3 to 30 months	Control	Exercise (gait, balance, and functional training)	Rate ratio 0.76 (0.70 to 0.82)	7989 (39 RCTs)	High[h]	Overall, there is a reduction of 24% (95%CI 18% to 30%) in the number of falls Guide to the data based on the all-studies estimate. If 1000 people were followed over 1 year, the number of falls would be 646 (95% CI 595 to 689) compared with 850 in the group receiving usual care or attention control
		All studies population					
		850 per 1000 [g]	646 per 1000 (595 to 689)				
		Specific exercise population					
		865 per 1000 [g]	657 per 1000 (606 to 709)				
Resistance exercises[i] versus control[b] (e.g. usual activities)	4 to 12 months	Control	Exercise (resistance training)	Rate ratio 1.14 (0.67 to 1.97)	327 (5 RCTs)	Very low[k]	The evidence is of very low certainty, hence we are uncertain of the findings of an increase of 14% (95% CI 33% reduction to 97% increase) in the number of falls
		All studies population					

		850 per 1000 [j]	969 per 1000 (570 to 1675)				Guide to the data based on the all-studies estimate. If 1000 people were followed over 1 year, the number of falls would be 969 (95% CI 570 to 1675) compared with 850 in the group receiving usual care or attention control
		Specific exercise population					
		630 per 1000 [j]	719 per 1000 (423 to 1242)				
3D (Tai Chi) exercise[l] versus control[b] (e.g. usual activities)	6 to 17 months	Control	Exercise (3D (Tai Chi))	Rate ratio 0.77 (0.61 to 0.97)	3169 (9 RCTs)	Moderate[n]	Overall, there is probably be a reduction of 23% (95% CI 3% to 39%) in the number of falls Guide to the data based on the all-studies estimate. If 1000 people were followed over 1 year, the number of falls is probably 655 (95% CI 519 to 825) compared with 850 in the group receiving usual care or attention control
		All studies population					
		850 per 1000 [m]	655 per 1000 (519 to 825)				
		Specific exercise population					
		1290 per 1000 [m]	993 per 1000 (787 to 1251)				
3D (dance) exercise[o] versus control[b] (e.g. usual activities)	12 months	Control	Exercise (3D [dance])	Rate ratio 1.34 (0.98 to 1.83)	522 (1 RCT)	Very low[q]	The evidence is of very low certainty, hence we are uncertain of the findings of an increase of 34% (95% CI 2% reduction to 83% increase) in the number of falls Guide to the data based on the all-studies estimate If 1000 people were followed over 1 year, the number of falls may be 1139 (95% CI 833 to 1556) compared with 850 in the group receiving usual care or attention control
		All studies population					
		850 per 1000 [p]	1139 per 1000 (833 to 1556)				
		Specific exercise population					
		800 per 1000 [p]	1072 per 1000 (784 to 1464)				
General physical activity (including walking) training[r] versus control[b] (e.g. usual activities)	12 to 24 months	Control	Exercise (general physical activity [including walking])	Rate ratio 1.14 (0.66 to 1.97)	441 (2 RCTs)	Very low[t]	The evidence is of very low certainty, hence we are uncertain of the findings of an increase of 14% (95% CI 34% reduction to 97% increase) in the number of falls Guide to the data based on the all-studies estimate If 1000 people were followed over 1 year, the number of falls may be 969 (95% CI 561 to 1675) compared with 850 in the group receiving usual care or attention control
		All studies population					
		850 per 1000 [s]	969 per 1000 (561 to 1675)				
		Specific exercise population					
		670 per 1000 [s]	764 per 1000 (443 to 1320)				

Multiple categories of exercise (often including, as primary interventions: gait, balance, and functional (task) training plus resistance training[u] versus control[b] (e.g. usual activities)	2 to 25 months	Control	Exercise (multiple types (including, as primary interventions: gait, balance, and functional (task) training plus resistance training))	Rate ratio 0.72 (0.56 to 0.93)[r]	2283 (15 RCTs)	Moderate[w]	Overall, there is probably a reduction of 28% (95% CI 7% to 44%) in the number of falls Guide to the data based on the all-studies estimate If 1000 people were followed over 1 year, the number of falls would probably be 612 (95%CI 476 to 791) compared with 850 in the group receiving usual care or attention control
		All studies population					
		850 per 1000[v]	612 per 1000 (476 to 791)				
		Specific exercise population					
		1205 per 1000 [v]	868 per 1000 (675 to 791)				

CI: confidence interval

[a] Exercise is a physical activity that is planned, structured and repetitive and aims to improve or maintain physical fitness. There is a wide range of possible types of exercise, and exercise programmes often include one or more types of exercise. We categorised exercise based on the Prevention of Falls Network Europe (ProFaNE) taxonomy that classifies exercise type as: i) gait, balance, and functional training; ii) strength/ resistance (including power); iii) flexibility; iv) three- dimensional (3D) exercise (e.g. Tai Chi, Qigong, dance); v) general physical activity; vi) endurance; and vii) other kind of exercises. The taxonomy allows for more than one type of exercise to be delivered within a programme.

[b] A control intervention is one that is not thought to reduce falls, such as general health education, social visits, very gentle exercise, or 'sham' exercise not expected to impact on falls.

[c] The all-studies population risk was based on the number of events and the number of participants in the control group for this outcome over the 64 RCTs. We calculated the risk in the control group using the median falls per person-year for the subgroups of trials for which a) an increased risk of falls was not an inclusion criterion (32 RCTs, 6434 participants), or b) increased risk of falls was an inclusion criterion (32 RCTs, 7872 participants).

[d] Subgroup analysis found no difference based on whether risk of falls was an inclusion criterion or not (test for subgroup differences: Chi2 = 0.1, df = 1, P = 0.75, I^2 = 0%).

[e] There was no downgrading, including for risk of bias, as results were essentially unchanged with removal of the trials with a high risk of bias on one or more items.

[f] Using Prevention of Falls Network Europe (ProFaNE) taxonomy, gait, balance, and functional training is: gait training = specific correction of walking technique, and changes of pace, level and direction; balance training = transferring bodyweight from one part of the body to another or challenging specific aspects of the balance systems; functional training = functional activities, based on the concept of task specificity. Training is assessment-based, tailored and progressed. Exercise programs included in this analysis contained a single primary exercise category (gait, balance, and functional training); these exercise programs may also include secondary categories of exercise.

[g] The all-studies population risk was based on the number of events and the number of participants in the control group for this outcome over the 64 all-exercise types RCTs. The specific exercise population risk was based on the number of events and the number of participants in the control group for this outcome over the 39 RCTs.
[h] We did not downgrade for risk of bias, as results were essentially unchanged with the removal of the trials with a high risk of bias in one or more items.
[i] Using Prevention of Falls Network Europe (ProFaNE) taxonomy, resistance training is any type of weight training (contraction of muscles against resistance to induce a training effect in the muscular system). Resistance is applied by body weight or external resistance. Training is assessment-based, tailored and progressed. Exercise programmes included in this analysis had resistance training as the single primary exercise category; these exercise programmes may also include secondary categories of exercise.
[j] The all-studies population risk was based on the number of events and the number of participants in the control group for this outcome over the 64 all-exercise types RCTs. The specific exercise population risk was based on the number of events and the number of participants in the control group for this outcome over the 5 RCTs.
[k] Downgraded by three levels due to risk of inconsistency (there was substantial heterogeneity (I^2 = 67%)), imprecision (wide CI due to small sample size), and risk of bias (removing studies with high risk of bias in one or more items had a marked impact on results).
[l] Using Prevention of Falls Network Europe (ProFaNE) taxonomy, 3D (Tai Chi) training uses upright posture, specific weight transferences and movements of the head and gaze, during constant movement in a fluid, repetitive, controlled manner through three spatial planes. Exercise programmes included in this analysis had 3D (Tai Chi) training as the single primary exercise category; these exercise programmes may also include secondary categories of exercise.
[m] The all-studies population risk was based on the number of events and the number of participants in the control group for this outcome over the 64 all-exercise types RCTs. The specific exercise population risk was based on the number of events and the number of participants in the control group for this outcome over the nine RCTs.
[n] Downgraded by one level due to inconsistency (there was substantial heterogeneity (I^2 = 83%). There was no downgrading for risk of bias, as results were essentially unchanged with removal of the trials with a high risk of bias on one or more items.
[o] Using Prevention of Falls Network Europe (ProFaNE) taxonomy, 3D (dance) training uses dynamic movement qualities, patterns and speeds whilst engaged in constant movement in a fluid, repetitive, controlled manner through three spatial planes. Exercise programmes included in this analysis had 3D (dance) training as the single primary exercise category; these exercise programmes may also include secondary categories of exercise.
[p] The all-studies population risk was based on the number of events and the number of participants in the control group for this outcome over the 64 all-exercise types RCTs. The specific exercise population risk was based on the number of events and the number of participants in the control group for this outcome in the sole RCT.
[q] Graded very low due to serious imprecision (only one cluster-RCT, with a wide CI due to small sample size).
[r] Using Prevention of Falls Network Europe (ProFaNE) taxonomy, physical activity is any movement of the body, produced by skeletal muscle, that causes energy expenditure to be substantially increased. Recommendations regarding intensity, frequency and duration are required in order to increase performance. Exercise programmes included in this analysis had general physical activity (including walking) training as the single primary exercise category; these exercise programmes may also include secondary categories of exercise.
[s] The all-studies population risk was based on the number of events and the number of participants in the control group for this outcome over the 64 all-exercise types RCTs. The specific exercise population risk was based on the number of events and the number of participants in the control group for this outcome in the two RCTs.
[t] Downgraded by three levels due to inconsistency (there was substantial heterogeneity (I^2 = 67%)), imprecision (wide CI), and risk of bias (removing studies with high risk of bias on one or more items had a marked impact on results).
[u] Exercise programmes included in this analysis had more than one primary exercise category. We categorised exercise based on the Prevention of Falls Network Europe (ProFaNE) taxonomy that classifies exercise type as: i) gait, balance, and functional (task) training; ii) strength/ resistance (including power); iii) flexibility; iv) three-dimensional (3D) exercise (e.g. Tai Chi, Qigong, dance); v) general physical activity; vi) endurance; and vii) other kind of exercises. The programmes of ten included, as the primary intervention, gait, balance, and functional (task) training plus resistance training. The exercise programmes may also include secondary categories of exercise.
[v] The all-studies population risk was based on the number of events and the number of participants in the control group for this outcome over the 64 all-exercise types RCTs. The specific exercise population risk was based on the number of events and the number of participants in the control group for this outcome over the 15 RCTs.
[w] Downgraded by one level due to inconsistency (there was substantial heterogeneity (I^2 = 71%)). We did not downgrade for risk of bias, as results were essentially unchanged with removal of the trials at a high risk of bias in one or more items